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A REVIEW OF THE NORTH AMERICAN SPECIES OF BALCLUTHA AND AGELLUS (HOMOPTERA : CICADELLIDAE).

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The genus *Gnathodus* was erected by Fieber in 1866 and *Jassus punctatus* Fall. was designated as the type. In 1900 Kirkaldy proposed *Balclutha* as a new name for the genus *Gnathodus* which was preoccupied and designated *punctatus* Thunb. as the type species. Baker in 1903 separated *Balclutha* into two genera. He named the new genus *Eugnathodus* and designated *E. abdominalis* V. D. as the type. From the original description of the genus it is apparent that Baker had in hand specimens of *E. abdominalis* but an examination of the type specimens revealed that they were specimens of *Balclutha*, and that the type was apparently designated in error. According to opinions 14 and 65 of the International Code of Zoological Nomenclature, *E. abdominalis* must remain the type of the genus *Eugnathodus*. As a result *Eugnathodus* Baker becomes a synonym of *Balclutha* Kirkaldy and *Agellus* was proposed by the authors as a new name for this genus and *A. neglectus* DeL. & Dav. has been designated as the type species.

Dr. Herbert Osborn is of the opinion that *Agellus* is synonymous with *Nesosteles* Kirkaldy which was erected in 1905. But since the description given by Kirkaldy is very inadequate and since neither Dr. Osborn nor the authors have been able to examine any type or authentically identified material there is some doubt regarding the generic validity of *Nesosteles*. As a result the name *Agellus* is used for this genus.

In 1896 Baker made a study of the species of these genera and attempted to separate them on the basis of external characters which are inadequate for the separation of most of the species of these two groups. No further work upon these species has apparently been attempted since, until the present treatment by the authors. During this study the chitinous structures of the male genital chamber, often known as the internal genitalia, have been used as a primary consideration in the designation of species. However, two species which differ markedly in external structures may have the same type of internal genital pieces

and such external characters have been used where they are distinctive and constant. In series of specimens where color characters and structures are quite variable, these various forms which have been described as different species are placed together under the same name.

Without the use of structural characters which have been illustrated in the present treatment it is practically impossible to separate the species of these genera. As a consequence several have been redescribed, some repeatedly, under several names. A few of the types are not available for examination and repeated efforts to obtain them for study have failed. When these can be studied further synonymy may be necessary.

The material examined in making this study was from the U. S. National Museum, Osborn Collection, DeLong Collection, Ball Collection, and small numbers of specimens sent in by various workers in entomology, especially the types from Iowa State College at Ames, Iowa; and the Colorado Agricultural College, Fort Collins, Colorado.

Types of the following species have been available for study:

<i>Balclutha manitou</i> G. & B.	<i>Agellus guajanae</i> DeL.
<i>Balclutha impicta</i> Van D.	“ <i>calcarus</i> DeL. & Dav.
“ <i>impicta</i> var. <i>flava</i> Bak.	“ <i>floridanus</i> DeL. & Dav.
“ <i>impicta</i> var. <i>maculata</i> , n.	“ <i>sandersi</i> n. sp.
var.	“ <i>knulli</i> n. sp.
“ <i>livingstoni</i> Bak.	“ <i>bisinnuatus</i> DeL.
“ <i>occidentalis</i> Bak.	“ <i>bifurcatus</i> DeL. & Dav.
“ <i>abdominalis</i> Van. D.	“ <i>abbreviatus</i> DeL. & Dav.
“ <i>arizona</i> n. sp.	“ <i>minutus</i> Osb.
“ <i>californica</i> n. sp.	“ <i>rosaceus</i> Osb.
“ <i>confusa</i> G. & B.	“ <i>marquesanus</i> Osb.
“ <i>viridus</i> Osb.	“ <i>pallidus</i> Osb.
“ <i>osborni</i> Van. D.	“ <i>areolatus</i> Osb.
“ <i>hyalina</i> Osb.	“ <i>tutuillanus</i> Osb.
<i>Agellus neglectus</i> DeL. & Dav.	“ <i>lineatus</i> Osb.
“ “ var. <i>pallidus</i> DeL.	“ <i>flavidus</i> Osb.
and Dav.	“ <i>virescens</i> Osb.

The writers have not been able to examine the Baker types. Mr. P. W. Oman states that these are not in the Baker collection, in the U. S. National Museum, and Dr. A. M. Boyce has very kindly examined the collection at Pomona College and has been unable to find the types there.

#### KEY TO GENERA.

1. Vertex narrower than pronotum, usually strongly produced and bluntly angled.....*Balclutha*.
- Vertex as wide as or wider than pronotum, usually almost parallel, margin less strongly produced and usually broadly rounded in front.....*Agellus*.

Genus **BALCLUTHA** Kirk.

First pair of wings with two apical cells, head narrower than pronotum, vertex bluntly angularly produced. Oedagus of male usually enlarged at base but not forming a dorsally directed process at anterior end.

Type of the genus *Balclutha punctata*, Thunberg.

KEY TO SPECIES OF BALCLUTHA.

1. Vertex broadly rounded, oedagus of male short, apex curved caudally and dorsally but not anteriorly..... *abdominalis*.  
 Vertex bluntly angled, male oedagus longer, directed anteriorly at apex and sometimes extending into preceding segment.....2.
2. (1) Male oedagus abruptly narrowed near base to a long and slender portion extending to posterior margin of preceding segment.....3.  
 Male oedagus shorter, basal portion more gradually narrowed to apical portion, which extends anteriorly only about half way to posterior margin of preceding segment.....6.
3. (2) Size smaller, less than 4 mm. in length, apex of male oedagus produced decidedly beyond posterior margin of preceding segment.....4.  
 Size larger, 5 mm. in length, apex of male oedagus produced anteriorly just to posterior margin of preceding segment.....*arizona*.
4. (3) Color yellowish, sometimes washed with pale green.....*impicta*.  
 Color dark green or if pale marked with black or brown.....5.
5. (4) Color dark green, veins conspicuously dark or rugose..... var. *osborni*.  
 Color yellowish or greenish mottled with dark brown or black, var. *maculata*.
6. (2) Size smaller, not exceeding 4 mm. in length, coloration variable, yellowish or greenish in color, sometimes heavily marked with brown or black..... *punctata*.  
 Size larger, more than 4.5 mm. in length.....7.
7. (6) Vertex bluntly angled, not greatly longer on middle than next the eyes..... *manitou*.  
 Vertex narrower and more strongly angled, about one half longer on middle than length next eyes..... *californica*.

**Balclutha abdominalis** V. D.

*Gnathodus abdominalis* V. D. Can Ent. 24 : 113, 1892.

Vertex bluntly rounded a little more than twice as wide as median length, produced more than one-half its length before anterior margins of the eyes. Pronotum with lateral angles prominent.

Color: Pale dirty yellow, ocelli dark.

Genitalia: Female last ventral segment truncate. Male oedagus in lateral view with a basal enlargement extending dorsally. Apical portion gradually tapering to a dorsally directed tip. Styles with thick blunt apical processes. Connective thick at base with rather a narrow incision. Apex enlarged and slightly indented at middle.

The holotype male from Jamesburg, N. J., has been examined and the above measurements and description prepared from that specimen. Although for several years this species was confused with *A. neglectus* DeL. and Dav., *abdominalis* is a

blunt headed *Balclutha* and the smallest of the group. Specimens of this species have formerly been identified very commonly as *B. impicta*, which is a different form with distinct genitalia. The name *abdominalis* has long been misapplied to the species now known as *Agellus neglectus*.

The holotype and cotype of this species are from New Jersey and are in the collection of Iowa State College, Ames, Iowa. In addition to the type locality, the species has been taken from Iowa, Mississippi, Pennsylvania, Connecticut, Virginia, Maryland, District of Columbia, Wisconsin, Ohio, Tennessee, Illinois, Alabama, Louisiana, New York, Puerto Rico, Haiti, Guatemala, and Trinidad.

#### *Balclutha arizona*, n. sp.

Resembling *manitou* in form and general appearance but larger and with different male genitalia. Length 5 mm.

Vertex rounded in front, almost parallel margined, slightly produced at middle and more than three times as wide between eyes as length at middle.

Color: pale green marked with yellow, especially on vertex, anterior portion of pronotum and scutellum. Apex of elytra smoky.

Genitalia: Female last ventral segment truncate. Male oedagus in lateral view with basal portion enlarged and with a slight dorsal finger process.

Body of oedagus suddenly narrowed and curved dorsally, then anteriorly to the wall of preceding segment. Connectives at base in ventral view with inner margins definitely horse-shoe shaped.

Described from a series of eight specimens collected at Tucson, Arizona, during August and September, 1928, and 1929, by Dr. E. D. Ball. Holotype male and allotype female in collection of E. D. Ball. Paratypes in collections of E. D. Ball and D. M. DeLong.

#### *Balclutha impicta* V. D.

*Gnathodus impictus* V. D. Can. Ent. 24 : 113, 1892.

*Gnathodus impictus* var. *flava* Bak. Can. Ent. 28, p. 38, 1896.

*Gnathodus impictus* var. *medius* Bak. Can. Ent. 28, p. 38, 1896.

Vertex bluntly angled, conspicuously narrower than pronotum, more than three times as wide as median length, produced two thirds of its length before anterior margins of the eyes.

Color: Yellow tinged with green.

Genitalia: Female last ventral segment truncate. Male oedagus in lateral view enlarged at base, apical portion long and narrow, extending dorsally, then directed anteriorly along dorsal wall into preceding abdominal segment. Styles deeply notched at apex, forming long, curved inner finger process. Connective widely and deeply notched at base, forming a pair of widely separated curved processes. Apex deeply notched so as to form two rounded divergent tips. The male lectotype and the male and female cotype from New Brunswick, N. J., have been examined and used in this study. These are located at Iowa State College, Ames, Iowa.

This species is very common, and in addition to the type locality, material has been examined from the following localities: New York, Illinois, Connecticut, Virginia, Pennsylvania, Ohio, Maryland, Wisconsin, District of Columbia, Michigan, Tennessee, Massachusetts, Indiana, New Hampshire, Vermont, New Mexico, Colorado, California, and Ontario, Canada.

**Balclutha impicta** var. **osborni** V. D.

*Balclutha osborni* V. D. check list Hemip. p. 75, 1916.

*Gnathodus viridus* Osb. 20th Rept. N. Y. St. Ent., p. 541, 1905.

Size and form of *impicta* and with genital characters the same. Color yellowish tinged with green. Venation conspicuous, dark green, rugose.

The holotype of this species from New York has been examined and differs from *impicta* only in coloration as listed above. The type is in the collection of Prof. Osborn.

This variety has been taken from the following localities: Ohio, New York, Pennsylvania, Illinois, Connecticut, California, and Ontario, Canada.

**Balclutha impicta** var. **maculata** n. var.

Size and form of *impicta* and with genitalia of the *impicta* type. Coloration as in well-marked specimens of *punctata*. Markings frequently very heavy with vertex, pronotum, and entire wings heavily mottled with brown. Often bright green with heavy markings on posterior portion of pronotum. Elytra with scattered spots on clavus, a large one at apex and three or four conspicuous spots on the central portion, brown. The degree of spotting varies considerably.

Described from a large series of specimens from Wisconsin, Tennessee, Connecticut, Pennsylvania and Washington, D. C. Holotype male from Bayfield, Wisconsin, collected September 10, 1916, and allotype female from Rock House, Ohio, collected April 25, 1915, by D. M. DeLong. Male and female paratypes from the above localities in the DeLong collection. Male and female paratypes from Iowa, Wisconsin, and New York in the collection of E. D. Ball, and from New York, Colorado, Maryland, and Virginia, in the collection of the U. S. National Museum.

**Balclutha punctata** (Thunb.).

*Cicada punctata* Thunb. Acta Upsala 4 : 21, 1782.

*Gnathodus confusus* G. & B. Hemip. Colo. p. 104, 1895.

*Gnathodus occidentalis* Bak. Can. Ent. 28 : 41, 1896.

*Gnathodus livingstoni* Bak. Can. Ent. 28 : 42, 1896.

Vertex bluntly angled, almost parallel margined, almost four times as wide between eyes as median length. Produced almost its entire length before anterior margins of the eyes. Pronotum with rather sharp lateral angles.

Color: Variable from gray or pale yellow to green and with markings variable or absent. In well-marked specimens with more or less broken transverse band

across vertex, mottlings on anterior portion and median longitudinal line of pronotum, and basal angles and median line on scutellum reddish or brown. Wings frequently with veins ferruginous or brown. Inner portion of clavus and a broken oblique band extending almost to costa, tip of clavus, spot on disc, posterior portions of antepical cells, portions of outer and inner apical cells, brown. In many specimens the markings are faint or entirely wanting and the wings are gray or whitish unmarked.

Genitalia: Female last ventral segment truncate. Male oedagus in lateral view gradually tapering from a broad elongated basal portion to a slender apical portion which is pointed and curves dorsally, then anteriorly, the apex reaching the middle of the segment or a little anteriorly. Styles deeply notched at apex with divergent inner finger-like structures. Connectives deeply broadly notched at base, forming widely separated curved processes. Apex deeply broadly notched, forming two rather narrow divergent processes.

This is the common European species and is widely distributed in North America. *B. impicta* var. *maculata* is marked exactly like *punctata* and has been confused with it in the past. These two forms, however, can easily be distinguished by means of the male genital characters. The type has not been examined but authentically identified material sent to us by W. F. China of the British Museum has been used in this study.

The distribution of this species includes the following areas: Iowa, New York, Mississippi, Colorado, Nevada, Idaho, Pennsylvania, Wisconsin, Utah, Illinois, Minnesota, Washington, Michigan, Arizona, Alabama, District of Columbia, Massachusetts, West Virginia, Montana, California, Ohio, Oregon, North Dakota, Kansas, Virginia, Wyoming, Maryland, Maine, Louisiana, Vancouver, Alaska, British Columbia, and Ontario.

#### *Balclutha manitou* (G. & B.).

*Gnathodus manitou* G. & B. Hemip. Colo. p. 105, 1895.

Vertex bluntly angled, more than three times as wide as median length. Pronotum strongly convexly rounded in front, vertex produced with almost entire length before anterior margins of the eyes.

Color: Yellow tinged with green, or greenish unmarked. Veins frequently strong, rugose.

Genitalia: Female last ventral segment slightly convexly rounded, almost truncate. Male genitalia the same as *punctata*.

This species can be separated only by its larger size and more angled vertex. The type of *manitou* has been examined. Type in collection of Colorado Agricultural College, Dept. of Entomology, at Fort Collins, Colorado.

This species has been taken from Alaska, British Columbia, Montana, Colorado, Washington and Arizona.

#### *Balclutha californica*, n. sp.

Resembling *manitou* but with vertex narrower and more sharply angled and produced. Length 4.7 mm.

Vertex strongly angled and produced at middle beyond anterior margins of the eyes. Length at middle about one half greater than length at eyes, more than three times as wide as median length. Pronotum strongly produced anteriorly.

Color: Pale green washed with yellow to dark green.

Genitalia: Female last ventral segment slightly sinuately produced. Male structures not different from those of *punctata*.

Described from a series of five specimens collected at Pasadena, Calif., during June, 1908 and 1909, by Dr. E. D. Ball, and two specimens collected at Ontario, Calif., by Prof. Herbert Osborn.

Holotype male in collection of Dr. E. D. Ball. Female allotype in Prof. Osborn's collection. Paratypes in Ball, Osborn and DeLong collections.

Type localities are Pasadena and Ontario, California.

Genus *AGELLUS*, Del. and Dav.

Although closely related to *Balclutha*, the genus *Agellus* differs in the following respects: Vertex more broadly rounded and scarcely produced before the anterior margins of the eyes, anterior and posterior margins almost parallel; head slightly broader than pronotum, lateral posterior angles of pronotum not wider than vertex. General venation as in *Balclutha* with inner sector of elytra not forked, two antepical cells being produced. Oedagus of internal genitalia with dorsal, basal protruding processes. In *Balclutha* the basal portion is enlarged and may extend dorsally but without finger processes.

Type of genus, *Agellus neglectus* Del. and Dav.

Because of the great similarity in size, appearance, and coloration of the species of this genus the genital characters offer the only certain means of separating and identifying them. As a consequence the species are based upon genital characters. The locality in which a species is found, however, may assist in its identification by limiting it to one or two possible species in the light of our present knowledge of distribution.

KEY TO SPECIES OF *AGELLUS*.

1. Color tawny, heavily marked with red (known only from female specimens) ..... *rosaceus*.
- Color some shade of green or yellow, without red markings, male of species known ..... 2.
2. (1) Female segment slightly notched either side of middle, appearing deeply notched, forming a broad sunken tooth. Pygofer of male in ventral view notched at caudal extremity so as to appear bifurcate ..... *bisinuatus*.
- Female segment if notched, without sunken tooth, pygofers of male not notched at apex ..... 3.
3. (2) Apical portion of male oedagus long, extending into preceding segment ..... *floridanus*.
- Apical portion of oedagus shorter, not approaching posterior margin of preceding segment ..... 4.



4. (3) Male oedagus in lateral view broad at base, gradually narrowing to apical portion, without dorsally directed anterior process or without basal end curving dorsally ..... *sandersi*.  
 Male oedagus in lateral view with basal portion more narrowed and either strongly curving dorsally or with process curving dorsally near basal end ..... 5.
5. (4) Male pygofer with a long spine extending ventrally at caudal margin, oedagus with short terminal portion, the anterior portion with a dorsally produced structure, the apex of which is inflated and curved anteriorly ..... *calcarus*.  
 Male pygofer without a long spine (a short one in case of *lineatus*).  
 The anterior dorsally produced portion of oedagus without anteriorly directed or curved terminal process ..... 6.
6. (5) Male oedagus long, rather uniformly wide throughout to near apex, where it becomes narrowed and bifurcate at apex ..... *lineatus*.  
 Male oedagus gradually tapered to pointed apex, which is not bifurcate ..... 7.
7. (6) Basal portion of oedagus curved strongly and produced dorsally, the apex of which is enlarged and has a small process which protrudes posteriorly; a heavy chitinous rod-like structure in the pygofer ..... *knulli*.  
 Basal portion of the oedagus with a dorsally produced process which tapers to the apex and is not enlarged; no chitinous rod-like structure in the pygofer ..... 8.
8. (7) Basal dorsally produced process of oedagus narrow, terminal portion long, extending to dorsal portion of segment. Styles with sharp pointed apices ..... *virescens*.  
 Basal dorsally produced process of the oedagus broader, terminal portion shorter, not extending to dorsal wall of segment. Apices of styles more bluntly pointed ..... 9.
9. (8) Female segment strongly roundly produced, slightly notched at middle, forming two lobate portions ..... *guajanae*.  
 Female segment truncate or slightly produced ..... 10.
10. (9) Female segment short at sides, gradually produced and notched either side of a median broad pointed tooth ..... *minutus*.  
 Female segment longer at sides, posterior margin truncate or slightly produced, margin often embrowned ..... *neglectus* and var. *pallidus*.

#### ***Agellus neglectus* (DeL. & Dav.).**

*Eugnathodus neglectus* DeL. & Dav. Ohio Jour. Sci. 33: 55, 1933.

Usually pale or dark brownish in color with blunt head and distinct genitalia. Length 3.5 mm.

Vertex almost four times as wide as long, broadly rounded, almost parallel margined. Pronotum three times as long as vertex. Color pale to dark brown, often with rather conspicuous markings on vertex, pronotum, and scutellum. Elytra smoky to white.

Genitalia: Female last ventral segment almost truncate, posterior margin slightly emarginate either side of a central slightly produced median tooth, which is inconspicuous. Posterior margin narrowly embrowned. Male valve



rounded posteriorly, plates triangular, about half as wide at base as long. Pygofers exceeding plates. Oedagus in lateral view rather heavy at base, anterior process extending dorsally, arising not far from the point of union with the connective. Body of oedagus extending caudally, tapered and extending dorsally and slightly posteriorly. Terminal portion about twice the length of the anterior process.

This species is very common and widely distributed and occurs in many areas.

Male holotype from Mt. Manitou, Colorado. Female allotype from the same locality, and male and female paratypes in the DeLong Collection. Paratypes in collection of U. S. National Museum and personal collections of Herbert Osborn and E. D. Ball.

This species has been taken from Tennessee, New York, South Carolina, Kansas, Iowa, Florida, California, Montana, Idaho, Colorado, Louisiana, North Dakota, Puerto Rico, Guatemala, South Dakota, Nevada, Nebraska, Texas, New Mexico, Virginia, Georgia, Utah, Washington, Ohio, Arizona, Kentucky, Illinois, Canal Zone, Pennsylvania, Mississippi, District of Columbia, and New Hampshire.

**Agellus neglectus** variety **pallidus** (DeL. & Dav.).

*Eugnathodus neglectus* var. *pallidus* DeL. & Dav. Ohio Jour. Sci. 33 : 56, 1933.

Form and general appearance of *neglectus* with structural and genital characters the same, but with pale green, pale yellow or white coloration. Dorsal portion of abdomen black or dark brown. Elytra whitish subhyaline unmarked.

Although appearing different this form can not be distinguished from *neglectus* by structural characters.

Male holotype and female allotype from Clarksville, Tennessee. Paratypes from the same locality. All are in the DeLong Collection.

This variety has been taken from Iowa, North Dakota, South Dakota, Kansas, New York, Tennessee, South Carolina, New Mexico, Arizona, Colorado, California, and Florida.

**Agellus guajanae** (DeL.).

*Eugnathodus guajanae* DeL. Jour Dept. Agr. Porto Rico. 7 : 267, 1923.

A round headed species, dark in color and with distinct genitalia. Length 3.5-4 mm.

Vertex broadly rounded, produced more than half its length before anterior margins of eyes. More than three times as wide as long.

Color: Brown, often tinged with pink and marked with brownish longitudinal vittae. Elytra yellowish or white, subhyaline, often tinged with brown.

Genitalia: Female last ventral segment rather deeply and narrowly notched at middle, forming two broadly rounding lobes. Male genital pieces as in *neglectus*.

Although the male characters of *neglectus*, *guajanae*, and *minutus* are exactly alike, the females are quite different in structure as well as in color and size.

This species was described from and named for arrows of sugar cane or "guajanas."

Collections examined revealed the fact that this species is present in Cuba, Haiti, Puerto Rico, Florida, Texas, Georgia, Nevada, South Carolina, Guatemala, Virginia and California.

#### *Agellus minutus* (Osb.).

*Eugnathodus minutus* Osb. Jour. Dept. Agr. Porto Rico 13 : 101, 1929.

Resembling *neglectus* in form and appearance, but smaller with pale coloration. Genitalia as in *neglectus*. Length 2.5 to 2.7 mm.

Vertex parallel margined, more than three times as wide between eyes as length at middle. Pronotum twice as wide as median length.

Color: Pale yellow or gray, elytra white.

Genitalia: Female last ventral segment notched either side of a broad sharp pointed median produced tooth. Male genital pieces the same as *neglectus*.

This species can be distinguished from *neglectus* by its small size, coloration and female genital segment.

Holotype, allotype, and paratypes in the Osborn collection. These specimens were collected at Aguirre, Puerto Rico, by Herbert Osborn.

#### *Agellus rosaceus* (Osb.).

*Eugnathodus rosaceus* Osb. Jour. Dept. Agr. Porto Rico. 13 : 102, 1929.

Resembling *guajanae* in size and form but tinged with bright red. Length 3.5 mm.

Vertex almost parallel margined, slightly produced at middle.

Color tawny, marked with bright red. Pronotum, dorsum of abdomen and basal portion of elytra especially heavily marked.

Genitalia: Female last ventral segment broadly roundedly produced. Only female specimens are known and the male character can not be examined or verified. This species is therefore separated on the color of the female.

Female holotype and paratypes from Aguirre, Puerto Rico, are in the Osborn collection.

#### *Agellus bisinuatus* Del.

*Eugnathodus bisinuatus* Del. Jour. Dept. Agr. Porto Rico. 7 : 266, 1923.

*Eugnathodus pallidus* Osb. Anns. Ent. Soc. Amer. 19 : 352, 1926.

*Balclutha hyalina* Osb. Anns. Ent. Soc. Amer. 19 : 352, 1926.

*Eugnathodus bifurcatus* Del. and Dav. Ohio Jour. Sci. 33 : 58, 1933.

*Nesosteles areolata* Osb. Bernice P. Bishop. Mus. Bull. 114 p. 266, 1934.

*Nesosteles tutuilana* Osb. Ins. Samoa. Pt. II. Hemiptera, p. 188, Br. Mus. Nat. Hist. 1934.

In general appearance resembling *neglectus*, but with distinct male genitalia and a bifurcate spine on the pygofer. Length 3.5 mm.

Vertex three and one-half times as wide as long, less than one third as long as pronotum.

Color: Gray to dull green tinged with yellow without definite color markings. Eyes usually dark.

Genitalia: Female last ventral segment with posterior margin almost truncate, slightly indented either side of middle, forming a broad blunt sunken tooth. A dark brown color marking on middle of posterior portion causes the segment to appear deeply notched either side of a median broad rounded tooth. The male genital pieces are unique. Style concave inwardly at base, constricted about middle then enlarged to form a pair of finger like processes by being deeply notched on outer margin. The basal one is heavy and short, the apical one is long and strongly curving outward. Oedagus in lateral view rather thick on basal half, without anterior process, terminal half curved and directed anteriorly from erect position of basal portion. Pygofer with a heavily chitinized spine extending into the genital chamber. A short chitinized spur also extends downward from the lower end of the large spine.

The bifurcate spine of the male and the dark margined female segment easily distinguish this species which has been described under several names.

Male paratypes of *pallidus*, *hyalina*, *bifurcatus tutuilana* and *areolata* have been boiled in potassium hydroxide and have proven to be this species.

This species has been taken from the following localities: Florida, Puerto Rico, Cuba, Marquesa Island and Bolivia.

Holotype male from Rio Piedras, Puerto Rico, is in the DeLong collection.

#### **Agellus floridanus** (DeL. & Dav.).

*Eugnathodus floridanus* DeL. & Dav. Ohio Jour. Sci. 33 : 56, 1933.

*Nesosteles marquesana* Osb. Bernice P. Bishop. Mus. Bull. 114, p. 265, 1934.

Resembling *neglectus* in general appearance, pale green in color and with distinct genitalia. Length 3 mm.

Vertex three times as wide as long and one third as long as pronotum. Elytra produced one third their length beyond apex of abdomen.

Color: Pale green marked with yellow. Elytra whitish subhyaline, veins white, claval area yellowish.

Genitalia: Female last ventral segment long, posterior margin roundedly produced, appearing notched at middle. Male genital pieces with styles in ventral view broad at base, strongly narrowed to finger-like pointed apices, which are divergent. Outer margin of style heavily chitinized on central portion and curved downward. Connective of oedagus more deeply notched at base than in other species. Oedagus in lateral view thick at base with anterior portion extended slightly forward, upward and then directed posteriorly. Body of oedagus extending dorsally and curving anteriorly into preceding segment.

Holotype male, allotype female and female paratypes from La Belle, Florida, and in the DeLong collection.

This species has been taken from the following localities: Florida, Texas, Haiti, Cuba, Guatemala, Mexico, Canal Zone, and Marquesa Islands.

*Agellus sandersi*, n. sp.

In size and general appearance resembling *A. floridanus* but with head more strongly produced and with distinct genitalia. Length 3 mm.

Vertex at middle produced almost its entire length before anterior margins of the eyes. Almost four times as wide as median length. Pronotum strongly convexly produced anteriorly.

Color: Smoky brown, vertex and anterior portion of pronotum with vermiculate brown markings. Abdomen dark brown.

Genitalia: Male oedagus strongly inflated at base, in lateral view, rapidly narrowed to a long slender apical portion which extends dorsally and anteriorly. In ventral view the oedagus appears long and slightly enlarged at apex.

Described from a single male specimen collected at Gamboa, Canal Zone, January 31, 1921, by J. G. Sanders. Holotype male in DeLong collection.

*Agellus calcarus* (DeL. & Dav.).

*Eugnathodus calcarus* DeL. and Dav. Ohio Jour. Sci. 33 : 57, 1933.

Resembling *neglectus* in form, size and appearance, but distinguished by the male genital characters and a large spine on each pygofer. Length 3.5 mm.

Vertex broadly rounded, three and one half times as wide as long, produced about one half its length before anterior margins of eyes.

Color: White to dull gray; vertex, anterior portion of pronotum, and basal angles of scutellum, ferruginous to yellow. Elytra white, venation white.

Genitalia: Female last ventral segment sinuate with rather prominent lateral angles and with underlying plates showing at side portions. Posterior margin appearing notched at middle because of small triangular hyaline portion.

Male styles broad at base, concave inwardly on basal margin, tapered toward apex. Conspicuously, abruptly notched toward base of outer margin forming a thick finger-like apical process which curves outwardly from inner margin. Connective broad at base, and broadly, shallowly notched. Oedagus in lateral view thick at base with anterior basal process directed dorsally and anteriorly. Posterior portion extending into a long whip-like process which is gradually narrowed and directed dorsally and anteriorly at apex. Pygofers of male with a heavily chitinized spur arising at the ventral caudal portion and curving upwardly and inwardly into the genital chamber.

This species can be easily distinguished from all others of the genus by the heavy spur on each pygofer.

This species has been taken from Florida, Puerto Rico, and the Marquesa Islands.

Holotype male and paratype male, collected at Miami, Florida, and deposited in the DeLong collection.

*Agellus lineatus* (Osborne).

*Eugnathodus lineatus* Osb. Anns. Carnegie Mus. 15 : 449, 1924.

*Eugnathodus flavidus* Osb. Anns. Ent. Soc. Amer. 19 : 351, 1926.

Resembling *guajanae* but with distinct genitalia and a dark color marking on the second apical cell. Length 3 mm.

Vertex produced more than one half its length before anterior margins of the eyes, parallel margined.

Color: Dirty yellow with median orange or brown line on vertex and scutellum. Elytra yellowish, costal half of second apical cell marked with a heavy brown stripe half the width of the cell.

Genitalia: Female last ventral segment sinuate, a black semicircular spot at middle. Male oedagus in lateral view with an anterior dorsally produced portion, posterior portion longer, curved dorsally then tip narrowed, curved anteriorly and bifid. In ventral view the oedagus appears rather long and shows the outwardly curved portions with a median notch between them at caudal extremity.

An examination of the type specimens of *lineatus* and *flavidus* Osborn show them to be exactly alike in genital structures, coloration and markings. The brown stripe on apical cell is conspicuous and characteristic of both.

Female holotype and male allotype in Osborn collection. The holotype is from Bolivia and the allotype from Cuba.

As far as known this species occurs in Cuba, Canal Zone, and Bolivia.

#### *Agellus knulli*, n. sp.

In general appearance resembling *floridanus* but slightly larger and with distinct genitalia. Length 3-3.5 mm.

Vertex rather strongly produced, more than one half its length before anterior margins of the eyes, more than three times as wide as long. Pronotum more than twice as wide as long.

Color: Pale green tinged with white.

Genitalia: Female last ventral segment with a rather broad shallow emargination. Brown color of the segment causing it to appear twice notched either side of a broad sunken median tooth. Male pygofers with a heavy chitinous bar extending from caudal ventral portion dorsally and somewhat anteriorly along the wall. Styles with heavy spine-like posterior portions which are divergent. Oedagus in lateral view with anterior portion extending dorsally and enlarged at anterior dorsal end. Posterior portion curved dorsally and anteriorly over anterior portion.

Described from a series of fourteen specimens collected by Prof. J. N. Knull at Brownsville, Texas, May 25 and June 1, 1934. We take pleasure in naming this unique species in honor of Professor Knull.

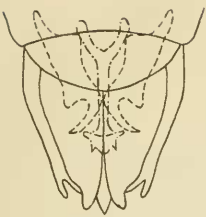
Holotype male and allotype female from Brownsville, Texas. Paratypes from Brownsville, Texas, all in the DeLong collection. One paratype male from Cuba in the Osborn collection.

#### *Agellus virescens* (Osb.).

*Eugnathodus virescens* Osb. Anns. Ent. Soc. Amer. 19 : 351, 1926.

*Eugnathodus abbreviatus* DeL. and Dav. Ohio Jour. Sci. 33 : 57, 1933.





A. BISINUATUS



A. BISINUATUS



A. CALCARUS



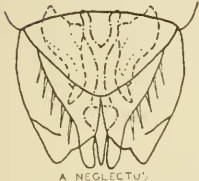
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A. CALCARUS



A. BISINUATUS



A. NEGLECTUS



A. NEGLECTUS



A. VIRESCENS



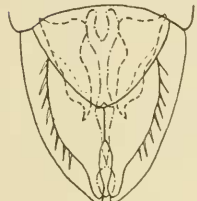
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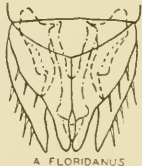
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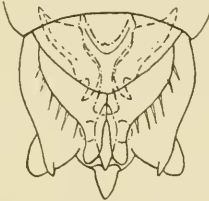
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A. VIRESCENS



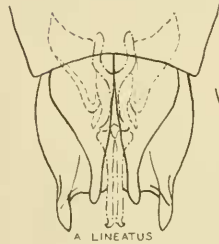
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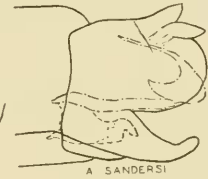
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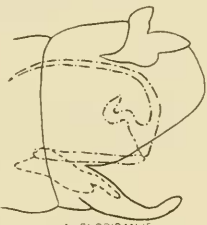
A. BISINUATUS



A. LINEATUS



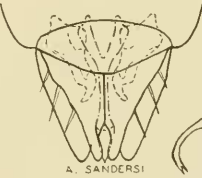
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A. FLORIDANUS



A. VIRESCENS



A. SANDERSI



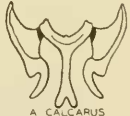
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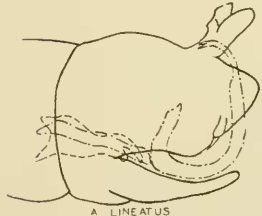
A. LINEATUS



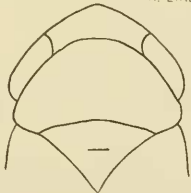
A. SANDERSI



A. CALCARUS



A. LINEATUS



A. LINEATUS



A. LINEATUS



A. NEGLECTUS



Short and robust, pale yellow in color and with distinct genitalia. Length 2.5 mm.

Vertex broadly rounded, more than three times as wide as long. Produced two-thirds its length before anterior margins of the eyes. Pronotum three times as long as vertex.

Color: Pale yellow or white washed with bright yellow. Eyes usually dark brown. Elytra whitish subhyaline, claval area washed with yellow.

Genitalia: Female last ventral segment slightly produced and sinuate either side of a slightly produced median tooth-like portion. Male valve short and rather broad. Plates about one and one half times as long as broad, apices blunt. Styles in ventral view rather long, wide at base, triangular, rather abruptly narrowed to divergent finger-like tips. Oedagus in lateral view with a long thick finger-like portion at base extending dorsally. Body of oedagus long and curved, extending dorsally and with apex directed anteriorly.

Male allotype, and female paratypes from Cuba and in the Herbert Osborn collection. This species has been collected in the following localities: Florida, Cuba, Puerto Rico, and Peru.

#### EXPLANATION OF PLATE 9.

Ventral and lateral views of the male genitalia showing styles and oedagus in normal position in the genital chamber. Also drawings of the styles in ventral view, the oedagi in side view, and the last ventral segment of the abdomen of several females.

#### EXPLANATION OF PLATE 10.

Ventral and lateral views of male genitalia, showing styles and oedagus in normal position in the genital chamber.

### FOUR LUPINE APHIDS.<sup>1</sup>

By GEORGE F. KNOWLTON.

This report deals with two described and two apparently undescribed aphids which infest *Lupinus* in western United States.

#### *Aphis* species on *Lupinus*.

Antennal III with 3 to 6 sensoria in alate.....*lupini*

Antennal III with 12 to 18 sensoria in alate.....*lupine-hansoni*, n. sp.

#### *Aphis lupini* Gillette and Palmer.

Gillette and Palmer, *Ann. Ent. Soc. Amer.*, 22 : 18-20, 1929.

This species has been collected in Utah upon *Lupinus* at Grouse Creek, Raft River Mountains (Tanner, Knowlton), and Wellsville, Utah. Wherever found by the writer, the large green, wingless females have been present in abundance.

<sup>1</sup>Contribution from the Department of Entomology, Utah Agricultural Experiment Station.

Authorized for publication by Director, April 12, 1935.